

ICT based implementation of ergonomics standards in orthopaedic surgery.

The perspectives and the role of train4orthomis online course

J. Bartnicka¹, A. Piedrabuena, R. Portilla², J.L. Moyano – Cuevas, J. B. Pagador, F. M., Sánchez-Margallo³, P. Augat⁴, D. Michalak, J. Tokarczyk⁵

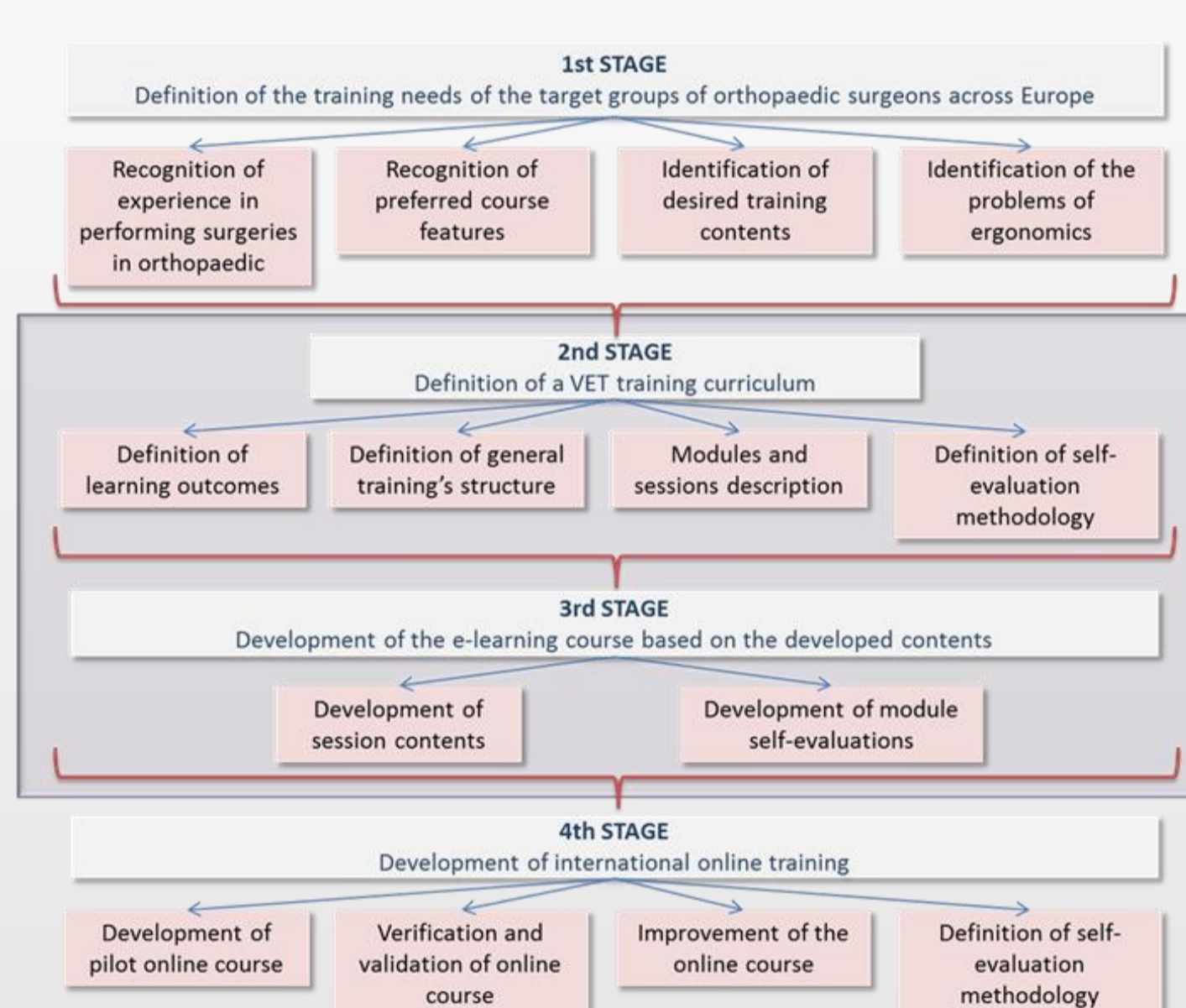
1. Institute of Production Engineering, Silesian University of Technology, Gliwice, Poland, Joanna.Bartnicka@polsl.pl; 2. Instituto de Biomecánica de Valencia, Valencia, Spain, {alicia.piedrabuena, raquel.portilla}@ibv.upv.es; 3. Jesús Usón Minimally Invasive Surgery Centre, Cáceres, Spain, {jmoyano, jbpagador, msanchez}@ccmijesususon.com; 4. Institute of Biomechanics, Trauma Center Murnau, Germany, Biomechanik@bgu-murnau.de; 5. KOMAG Institute of Mining Technology, Gliwice, Poland, {dmichalak, jtokarczyk}@komag.eu

INTRODUCTION

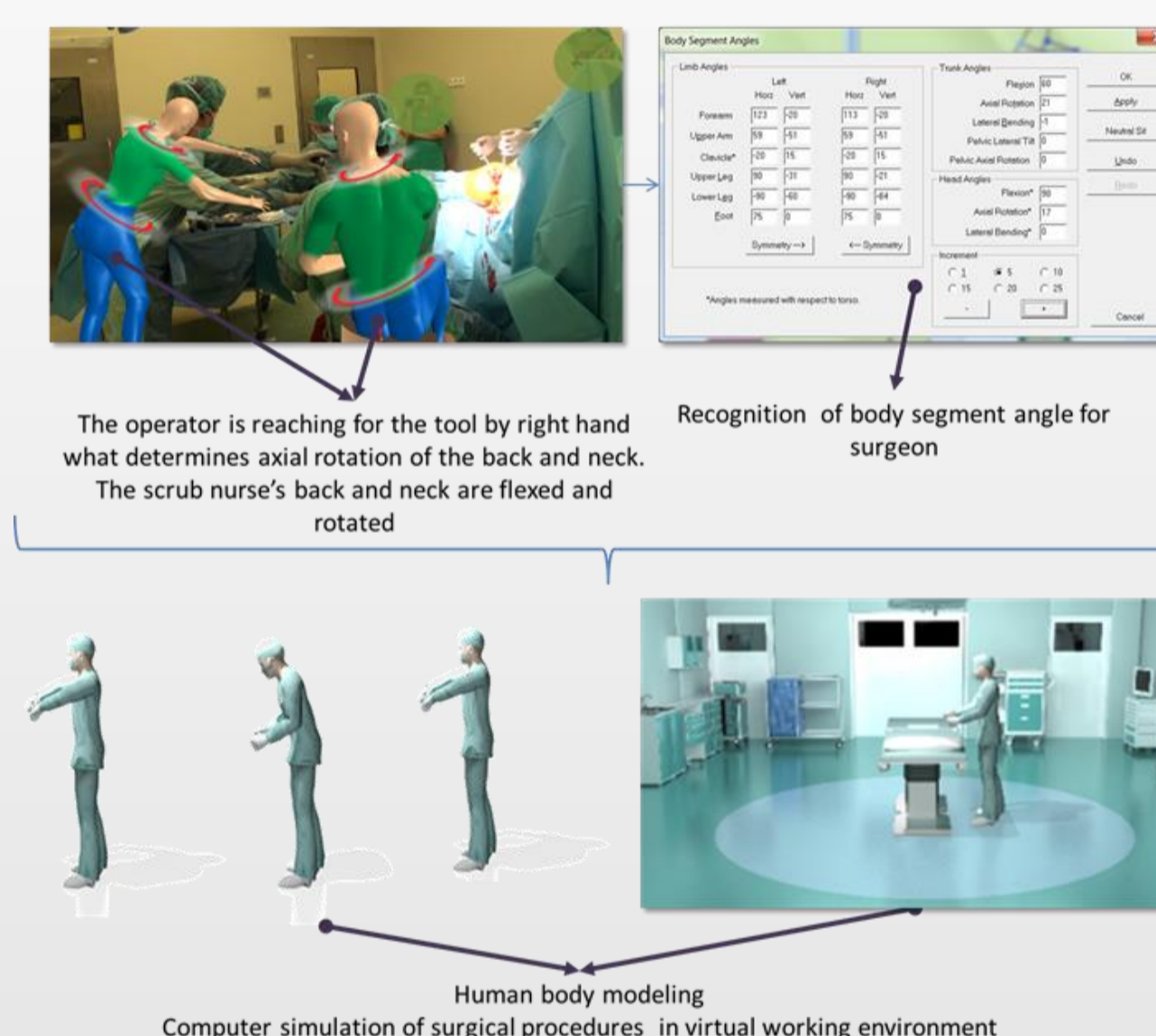
Orthopaedics is one of the essentially domains in surgery. This results from the raising orthopaedic disorders magnified specifically by civilization factors. However, the international survey which was conducting within 2015 on 41 orthopaedic surgeon from Europe confirmed the necessity of improving ergonomics in operating room while performing orthopaedic surgeries. Simultaneously they indicate such physical problems like: neck pain, thoracic and lumbar pain, stiff neck, fatigue and musculoskeletal stress, fatigue in the legs and feet and mental fatigue or headache. Taking into account the challenge that is improving ergonomics in orthopaedic surgeries there was formulated the work problem as follows: how to create and implement unify ergonomics standards while performing orthopaedic surgical procedures to make them more comfortable and safe for surgeons? In order to answer this research question the aim of the study was defined as developing the specification and content for creating the unified online training course on ergonomics directed to orthopaedic professionals regardless the country they live and work. The assumption of this online training course is to include ICT functionalities to make the training mobile and interactive.

DEVELOPMENT

The aim of the study forced the development of certain methodology which is composed of four stages. In particular, the main issues from the marked area covering second and third stages are the subject matter of this article (see the left Figure).



Based the methodological structure and assumptions the implementation of ergonomics standards was performed obtaining as a result the accomplishment of all tasks described within second and third stages. First of all the detailed description of Curriculum documentation was prepared taking into account the recommended three groups of learning outcomes: knowledge, skills and competences. The description of learning outcomes is reflected in the training structure. Considering the theoretical and practical aspects of the training, the course is divided into four modules. Each module is divided into sessions which correspond to ELOs and have duration of about 2 to maximum 6 hours. It should be highlighted that the great part of training contents is prepared based on procedural knowledge what corresponds to the surgeons' expectations.



Particularly the procedural knowledge reflects certain type of activities and resources needed to perform orthopaedic surgery of hip or spine taking into account ergonomic criteria. However there were four phases of developing training materials: *video registration of real surgeries and/or surgeon's body segment angles measurement; *ergonomic analysis; *developing general (for orthopaedics) and specific (for certain type of surgical procedure) recommendations; *notation of training materials with the use of visual representation like static and dynamic graphics. For instant, in the right Figure the training materials development is presented taking into account the registration, body segment angles identification and virtual working environment creation.

CONCLUSIONS

Train4OrthoMIS course is the professional knowledge platform directed to orthopaedic surgeons the aim of which is to improve their practice in ergonomics area. The need of developing the course results from the occupational hazard in MIS surgery and simultaneously a lack of ergonomics contents within standard high education system. This problem is common for surgeons population regardless the country they practice.

The recognition of ergonomic problems while performing orthopaedic MIS on international level was the opportunity to complete formative e-learning content according to real surgeons' needs and implement ergonomics standards in orthopaedic surgery. ICT tools are here the accurate solution allowing the wide audience of orthopaedic practitioners an access to ergonomic knowledge. In the same time the currently results showed that certain ICT functionalities, like making declarative and practical knowledge available and explicit by interactive graphical representations or online transferring knowledge in line student – academic tutor, can be successfully used for improving practical skills of surgeons in ergonomic area and help them to make working condition more user friendly.

REFERENCES

- [1] Bartnicka, J., Piedrabuena A., Portilla, R., Moyano – Cuevas, L., Pagador, J.B., Augat, P., Tokarczyk, J., & Sánchez, Margallo, F.M. (2016). International E-Learning for Assuring Ergonomic Working Conditions of Orthopaedic Surgeons: First Research Outcomes from Train4OrthoMIS. *International Journal of Educational and Pedagogical Sciences*, 3, No:1, 358-363
- [2] Berguer, R. (1999). Surgery and ergonomics. *Archives of Surgery*, 134, 1011-1016,
- [3] Davis, W.T., Fletcher, S.A., & Guillaumondegui, O.D. (2014) Musculoskeletal occupational injury among surgeons: effects for patients, providers, and institutions. *J Surg Res*, 189, 207-212
- [4] DeLone, W.H., & McLean, E.R. (2003). The DeLone and McLean model of information systems success: a ten-year update. *J. of Management Information Systems*, 19, 9-30
- [5] <http://www.istshare.eu/ict-technologie-informacyjno-komunikacyjne.html>
- [6] Muzio, J.A., Heins, T., & Mundell, R. (2002). Experiences with reusable E-learning objects. *From theory to practice. Internet and Higher Education* 5., 21-34
- [7] Ten Berge, T., & van Hezewijk R. (1999). Procedural and Declarative Knowledge. *An Evolutionary Perspective. Theory & Psychology*, 9, 605-624
- [8] Valderrama, R.P., Leandro Balladares Ocan, L.B., & Sheremetov, L.B. (2005). Development of intelligent reusable learning objects for web-based education systems. *Expert Systems with Applications*, 28, 273–283
- [10] Van Veelen, M., Nederlof, E., Goossens, R., Schot, C., & Jakimowicz, J. (2003) Ergonomic problems encountered by the medical team related to products used for minimally invasive surgery. *Surg Endosc*, 17, 1077-1081